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AËRONAUTICAL MAPS AND AËRIAL TRANSPORTATION

By **HENRY WOODHOUSE**
Editor of *Flying*

Maps have always been most important factors in military and naval operations, just as they have been important factors in peaceful travel over land and water. To the aviator the map is as important as to the navigator at sea; and just as the mariner's chart must tell the navigator of currents, depths of the water, and locations of rocks and reefs, so the aëronautical map must tell the aviator of the character of the land and the configuration of the bodies of water below. It must show the land as it is, the exact shape of cities, woods, and lakes; the course of rivers, railroads, and roads; it must indicate clearly the prominent landmarks and the established aërodromes and open fields suitable for landings, etc. In short, the aëronautical map must show the land as nearly as possible as it looks to the aviator from the air.

FOUR TYPES OF AËRONAUTICAL MAPS

The more important aëronautical maps in current use, especially in the present war, may be divided into four types. These, with the leading representatives of each type, are as follows:

(1) *General aëronautical maps.* These are maps that have already been in existence for some time but are on a scale suitable for aviation, say three or four miles to the inch. They are usually based on the larger-scale topographic sheets. Such a map is the Carte de France on the scale of 1:200,000 in 86 sheets published by the Service Géographique de l'Armée. On it roads are shown in red, railroads in black, forests and woods in green, and waterways in blue.

(2) *Special aëronautical maps.* These are maps that have been prepared primarily for aviation. They represent the usual map elements in a bold and striking way, stressing the features of importance to the aviator.

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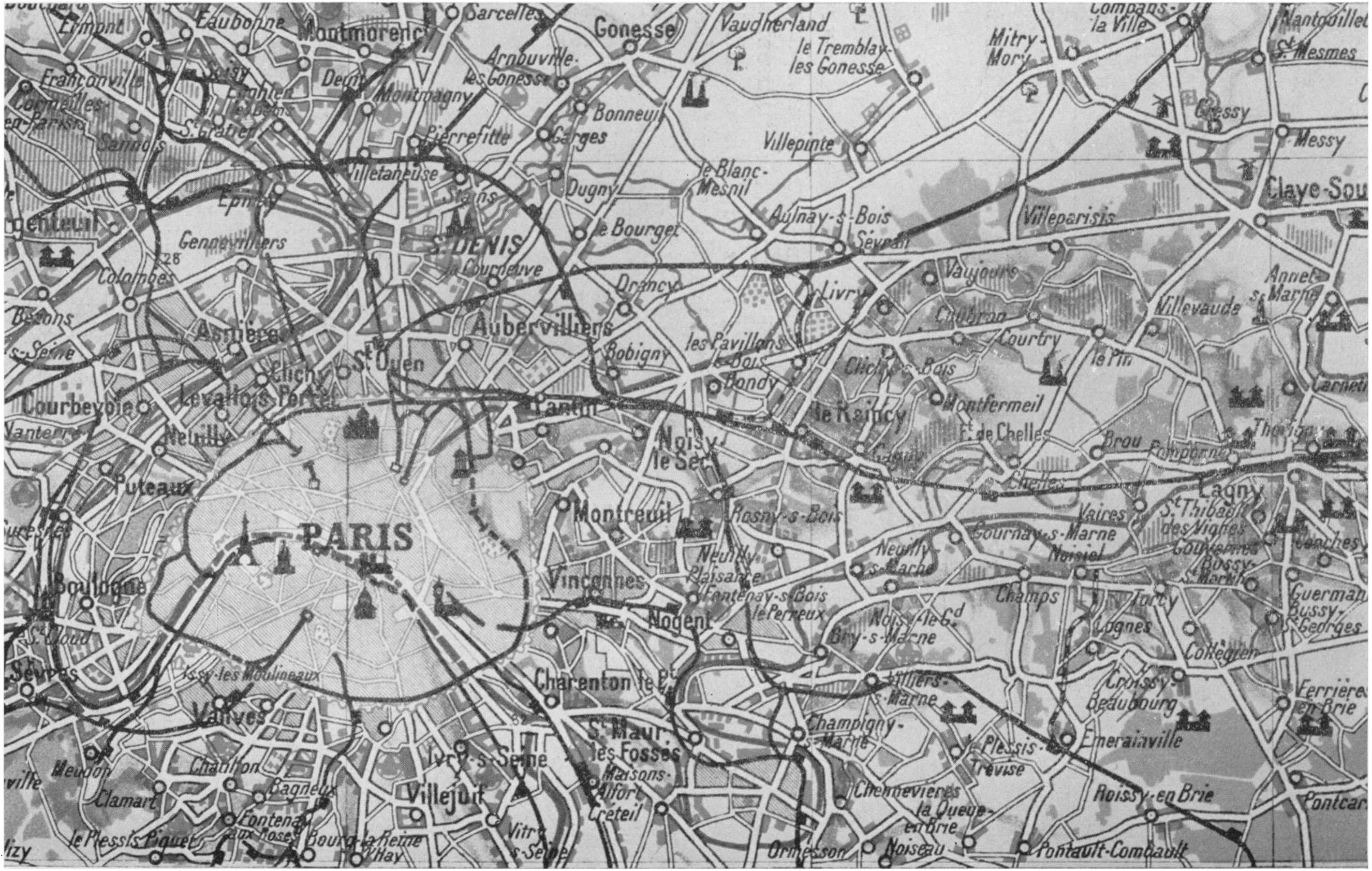

FIG. 1—A section of the Paris sheet of the aëronautical map of France, 1:200,000, published by the Service Géographique de l'Armée. In maps of this type the usual elements are represented in a bold and striking way, the features of importance to the aviator being emphasized. Thus they have special symbols for aërodromes and landing fields and for such landmarks as prominent churches, factory chimneys, windmills, castles, and monuments.

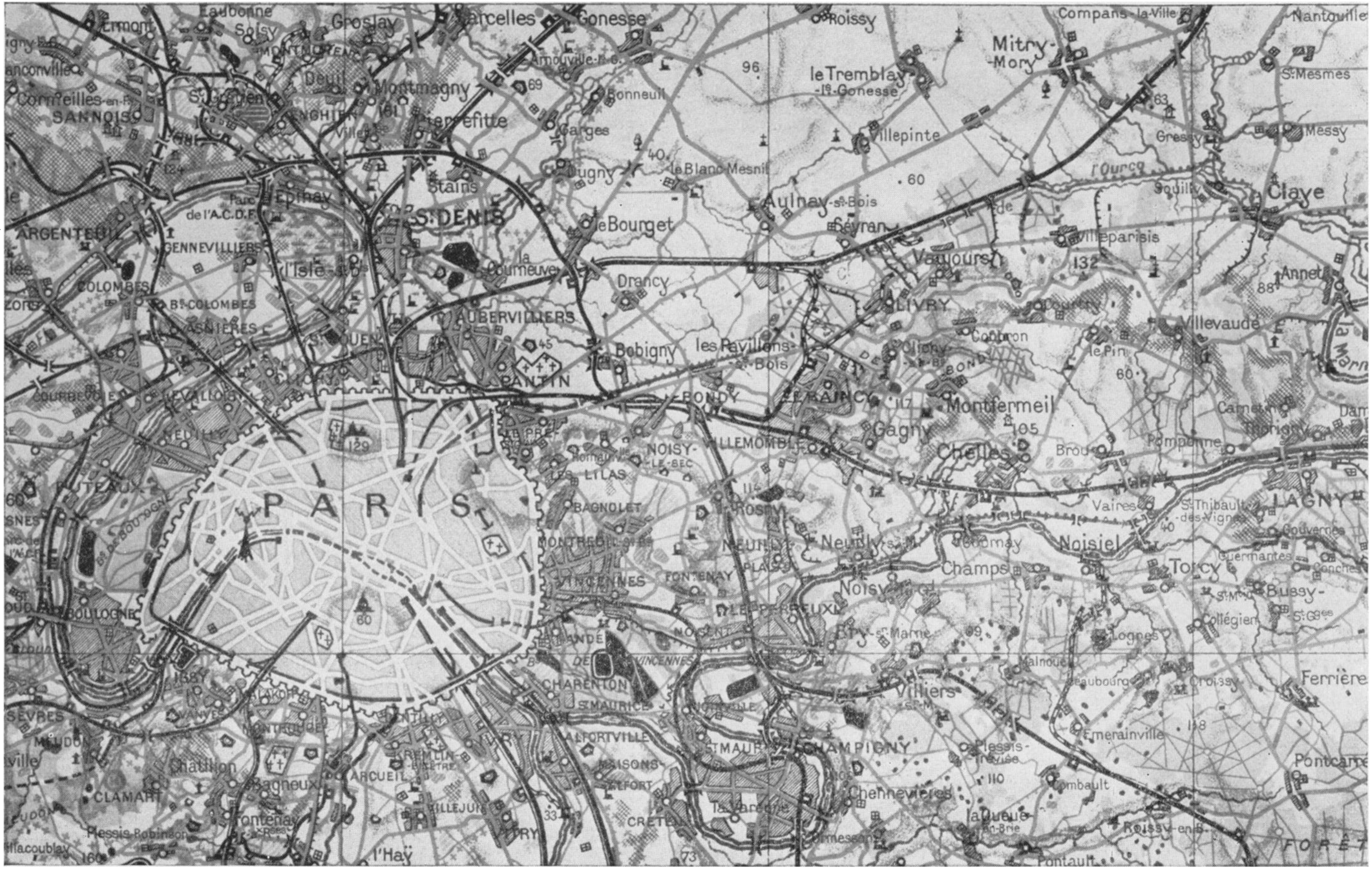

FIG. 2—A section of the Paris sheet of the aëronautical map of France, 1:200,000, published by the Aéro-Club de France. This section embraces exactly the same area, and on the same scale, as the figure above. The symbols are similar in type.

In addition they show aërodromes for aëroplanes and dirigibles; landing fields, when there are no hangars; stations where gas for dirigibles is obtainable; the approximate shape of cities, towns, and villages, and such landmarks as prominent churches, railroad stations, windmills, smokestacks, castles, and monuments. The two foremost maps of this type (see Figs. 1 and 2) are the Carte Aéronautique de la France[1] on the scale of 1:200,000 published by the Service Géographique de l'Armée since 1911 (at least four sheets issued before the war) and the Carte de France on the same scale published by the Aéro-Club de France since 1911 (at least thirteen sheets, covering the northeastern frontier, issued). A new and revised edition of this map is in course of publication.[2]

These maps are used for long-distance flights and raids. When a flight is planned, the aviators go over the map, lay down the route to be followed, and study the details given on the map, together with any other information that they may be able to get regarding the configuration of the land over which they will fly, the possible landing places, etc. Needless to add, the aviators make every effort to ascertain as closely as possible the nature of the enemy country in order to be sure to recognize places where bombs are to be dropped, as well as places where anti-aircraft guns are most likely to be waiting.

(3) *Special aëronautical maps for permanent aërial routes.* These give the information required by an aviator only for a strip of territory along a given route. This type of map originated in Italy and has not yet been put into general use outside of that country. The example reproduced herewith (Fig. 3) represents the first lap of an air route traversing the length of the Po Valley from Turin to Pordenone. The distinctive feature of this map is the treatment of the air route and its landing places. The route itself, a permanent one, is indicated as a red dotted line. The aërodromes are shown as red rings; the landing places which permit landing from two sides are shown as two red dots of the same size connected by a red line; the landing places which permit landing from one side only are indicated by two red dots of unequal size connected by a short line. The large dot represents the approximate place where the wheels of the aëroplane must touch on landing. The line that connects it with the smaller dot shows the direction toward which the aëroplane must run in landing. The distance between the first dot and the second is usually about 300 meters, and the width is usually about 100 meters.

This type of map greatly facilitates aërial navigation. An American map of this kind is the Sperry aëronautical map, which was described in the July, 1917, *Review*.[3] It was evolved independently of the Italian map and has several improvements over the latter. In this series maps of the air routes between New York and Chicago, New York and Newport News, Va., and of Long Island, have already been prepared. In addition to the topographical information they carry, it is planned to show aërodromes (these are being established partly by the Army Air Service and partly by civil organizations); prominent landmarks; and the landing places for twenty-five to fifty miles on either side of the route. Each leg of the route is marked with its magnetic bearing, both coming and going, and compass roses showing the magnetic variation in a given district are added at frequent intervals. The bearing from one city to another is determined by projecting the line of flight between those two cities and then transferring this line by means of parallel rulers to the nearest compass rose. As all the bearings are magnetic, the pilot simply steers his craft according to the charted reading.

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[1] Cf. P. Pollachi: La Carte Aéronautique du Service Géographique de l'Armée, *Ann. de Géogr.*, Vol. 20, 1911, pp. 311-315.

[2] La "Carte-Avion": Nouvelle carte aéronautique de l'Aéro-Club de France, *l'Aérophile*, Feb. 1-15, 1917, pp. 68-69.

[3] O. B. Whitaker: Aëronautical Charts, *Geogr. Rev.*, Vol. 4, 1917, pp. 1-5; reference on pp. 2-4.

A map is also being prepared of the air-line, or great circle, route between New York and San Francisco, which would make it possible for any aviator to fly across the continent without losing his way. The Aero Club of America proposed to call this route the Woodrow Wilson Aërial Highway,

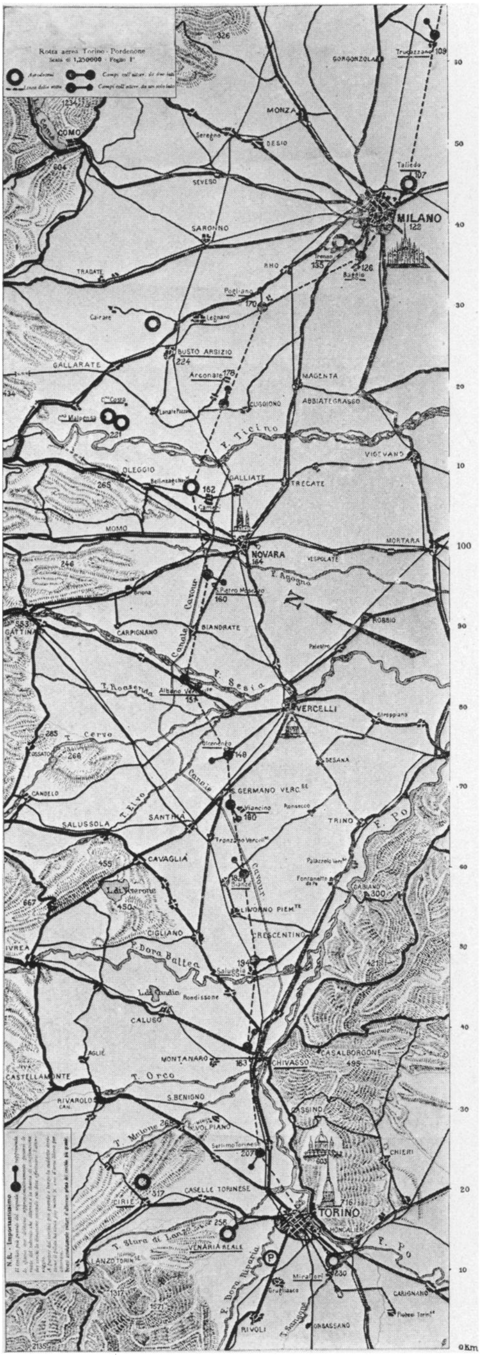

FIG. 3—Reduced photograph of the first sheet of an Italian air route map, 1:250,000, of the Po Valley from Turin to Pordenone. (Continued on the left.)

The air route is shown in a red dotted line (the line leading from Turin via Novara to Milan and beyond), aërodromes in red rings, and landing places by two dumbbell-shaped symbols with circles of equal or unequal size depending on whether the landing can be effected from two sides or from one side only.

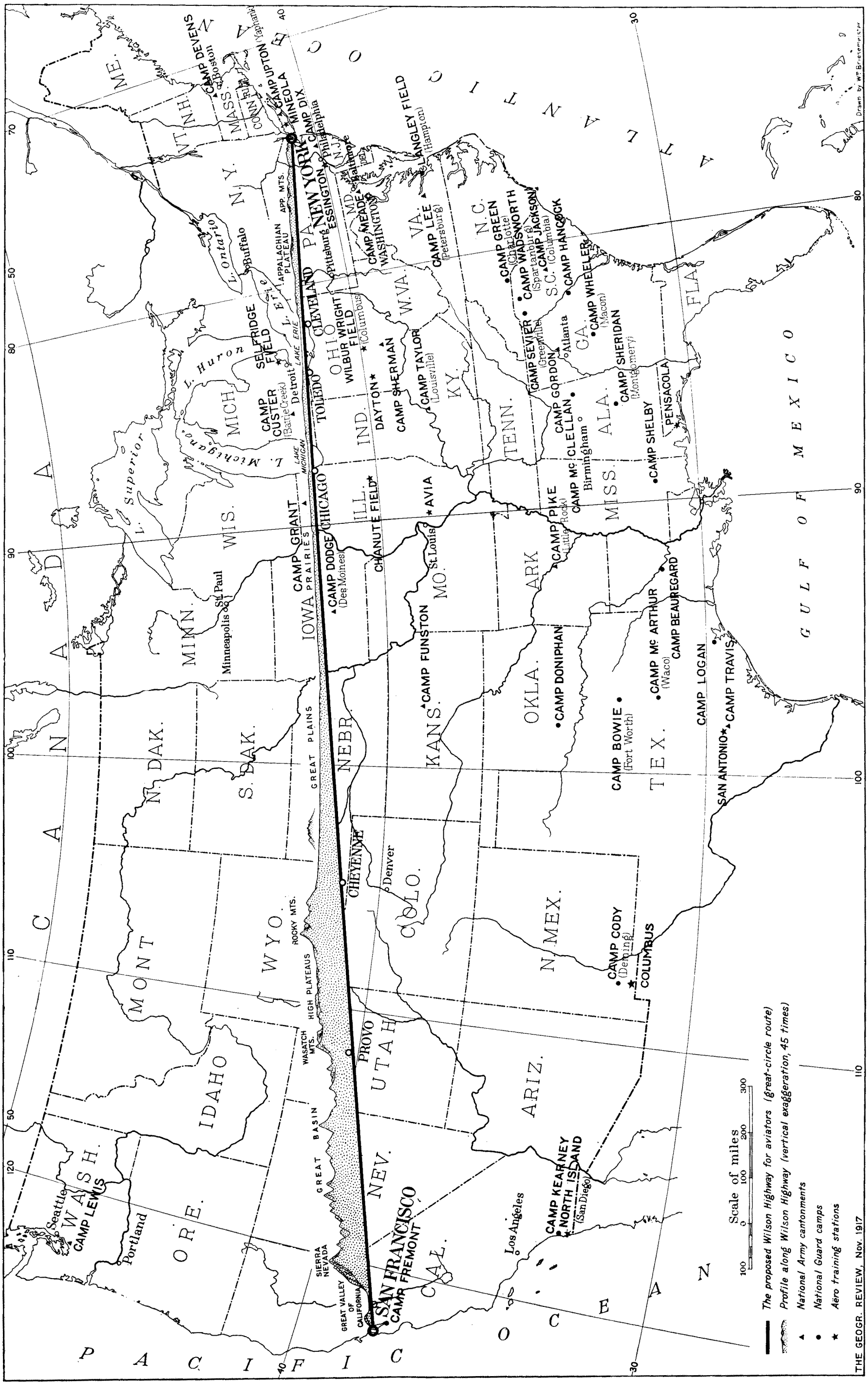

FIG. 4—Outline map of the United States showing the route of the proposed Woodrow Wilson Aërial Highway and military camps and aviation stations. Scale, 1:26,000,000.

and, President Wilson having expressed his approval, work has been started to outline the route in detail and establish the landing places along the route. The map will not only show the narrow strip along its course, but will include lines leading from the main line to central landing places like Erie, Cleveland, and Detroit. The general course of the Wilson Highway is shown on Figure 4.

As soon as regular air lines are established to carry passengers and mail and aircraft start from a given station at a given time daily, it will be possible to insert on this type of map the approximate time at which the aircraft must pass certain places, so that the aviator will be able to navigate the air with even less trouble than the mariner navigates the sea. In fact, an aëroplane equipped with the Sperry automatic pilot could be set to follow the compass direction in trips of a few hundred miles, and thereafter the pilot would have practically nothing to do, as the automatic pilot would control his machine completely. The pilot would only have to guard against the drift due to side winds, which he would do by occasionally comparing his map with the ground below and setting his course right if necessary. Otherwise, finding out his whereabouts would be easy. Knowing the speed of his machine and the approximate time required to reach different places, he could determine by a glance at the watch at what point he should be at that hour.

(4) *Photographic maps.* It is on maps of this type that the military operations on the present battle fronts are based. In the conduct of these operations photographic maps are essential. They are re-made daily, often several times a day, to include the changes shown by the photographs taken by the aviators from their aëroplanes. These photographic maps show the configuration in the most minute details, and with the utmost care, as the success of certain operations depends upon the exactness of the smallest topographical details.

Aërial photography is now almost an exact science. The aviator from a height of 6,000 to 8,000 feet can take a photograph which will include and show clearly the whole of Manhattan Island; and the photograph can be enlarged to show the main streets, docks, bridges, and buildings. A series of photographs can be taken from New York to Albany which can be combined to form a continuous map of the entire route and show every detail to scale—such a map as could not be made by any other method even with the expenditure of years of time and large sums of money. Or the aviator, flying at what is considered a slow rate for an aëroplane, about 70 miles an hour, can take a motion picture of the entire route, giving the exact topographical conditions. This would permit the military authorities within twenty-four hours to conduct operations with certain knowledge as to the conditions between Albany and New York. Ultimately, it may be possible to add on the margins of the printed route maps the photographic map of the corresponding strip of territory, and thus make the reading of the map and the identification of the terrain a matter of no difficulty whatever.

AN ABANDONED INTERNATIONAL CONVENTION ON AËRONAUTICAL CARTOGRAPHY

The war prevented the holding of an international convention which was to discuss and decide on the basic principles for an aëronautical map of the world. This convention was being arranged in the United States by the Aero Club of America at the suggestion of Rear Admiral Robert E. Peary, Chairman of the Committee on Aëronautical Maps and Landing Places of the Aero Club of America. Admiral Peary attended the Tenth International Geographical Congress, held at Rome in March and April, 1913, at which the subject of aëronautical maps was discussed. The report of this congress and the principal address delivered were translated from the Italian by the writer and printed in *Flying,* the organ of the Aero Club of America, for September and October, 1913.[4]

At this congress no decision was reached or action taken towards adopting basic principles for the making of aëronautical maps, because it was recognized by the delegates, as it had been recognized by the delegates that attended the Congress of the International Aëronautic Federation at Vienna in June, 1912, that the first step to be taken should be an agreement on a scale and the conventional signs to be adopted. The aëronautical map of the world was then to be supplemented by aëronautical maps of different countries, and of parts of different countries, made on the accepted scale and with the use of the same conventional signs.

It was to bring about this international agreement that the Aero Club of America was arranging to hold an international convention in the United States, the object being to do for the world aëronautical map what was done for the international map of the world by the International Geographical Congress at Geneva in 1908. The necessary arrangements were to be made, through diplomatic channels or otherwise, to facilitate the execution of the sheets of this map overlapping the frontiers of different countries. Although the war prevented the holding of this convention, the Committee on Aëronautical Maps and Landing Places of the Aero Club of America continued its work to advance the project.

The purpose of this committee, stated in April, 1914, was as follows:

(1) To bring about an understanding between the sporting, military, and scientific authorities of different countries; and also an agreement to use uniform scales and conventional signs in making aëronautical maps.

(2) To make an aëronautical map of the United States and of the central parts of South and Central America and Canada; and to do this with the co-operation of aëro clubs affiliated with the Aero Club of America, and of aëro clubs of South and Central America and Canada.

(3) To urge the establishment of a chain of aërodromes for landing aëroplanes and landing stations for flying boats and hydro-aëroplanes, so that

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[4] Giovanni Roncagli (translated by Henry Woodhouse): To Make an Aëronautical Map of the World, *Flying,* Vol. 2, 1913, No. 8, pp. 16-17 and 24, No. 9, pp. 8-9 and 30.

aviators who wish to make long flights over water or land may not be handicapped by the lack of landing places, as they are now. One of the reasons why France, Germany, and Italy have more flying than we have, is that there are special landing places for aviators near all the cities and central towns. France alone has over three hundred landing places where aëronauts can get supplies and keep their machines over night.

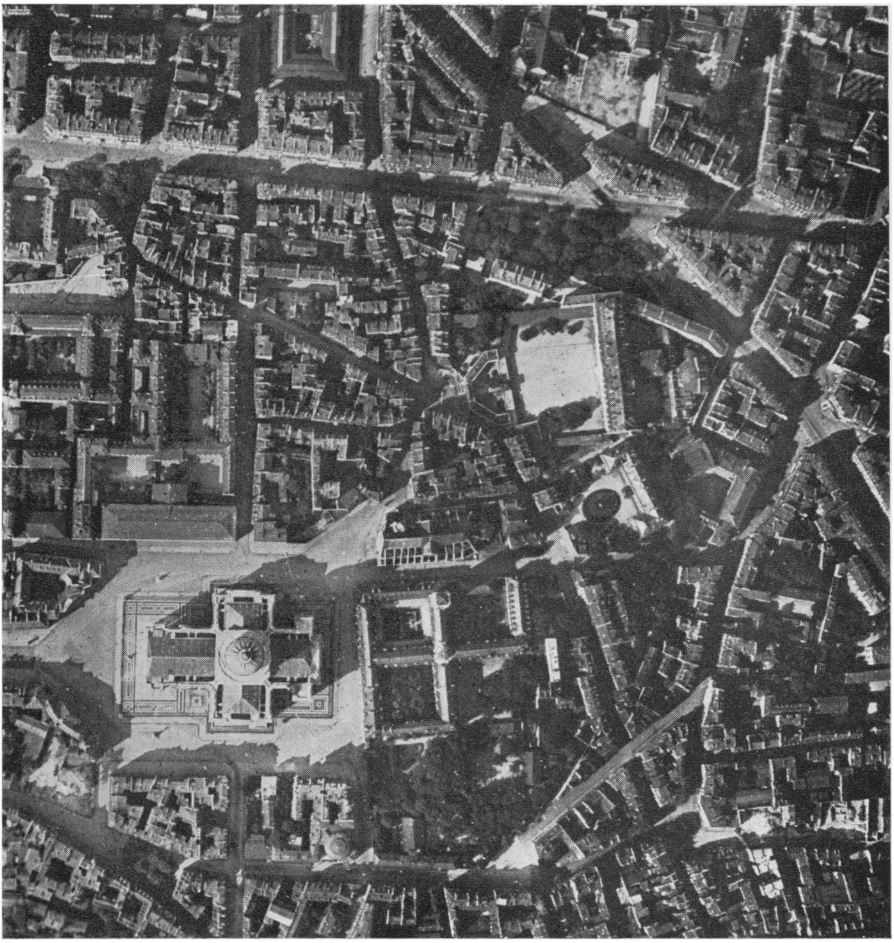

FIG. 5—A part of the Latin Quarter of Paris photographed from an aëroplane. The prominent building in the lower left of the picture is the Pantheon; in the right center the group of buildings surrounding a large courtyard belong to the Ecole Polytechnique. (Photo copyright by Underwood & Underwood.)

This photograph strikingly illustrates the value of photographic mapping from an aëroplane. When the view is taken vertically downwards, as in this case, the photograph is practically equivalent to a map; when the view is taken obliquely, as in Figs. 8 and 9, the photograph can easily be reduced to the ground-plan form of a map by an optical apparatus designed for this purpose. In either case the method is far more rapid and comprehensive, and less laborious and expensive, than the methods of surveying usually employed heretofore.

(4) To encourage long-distance flying by chart and compass, as is now

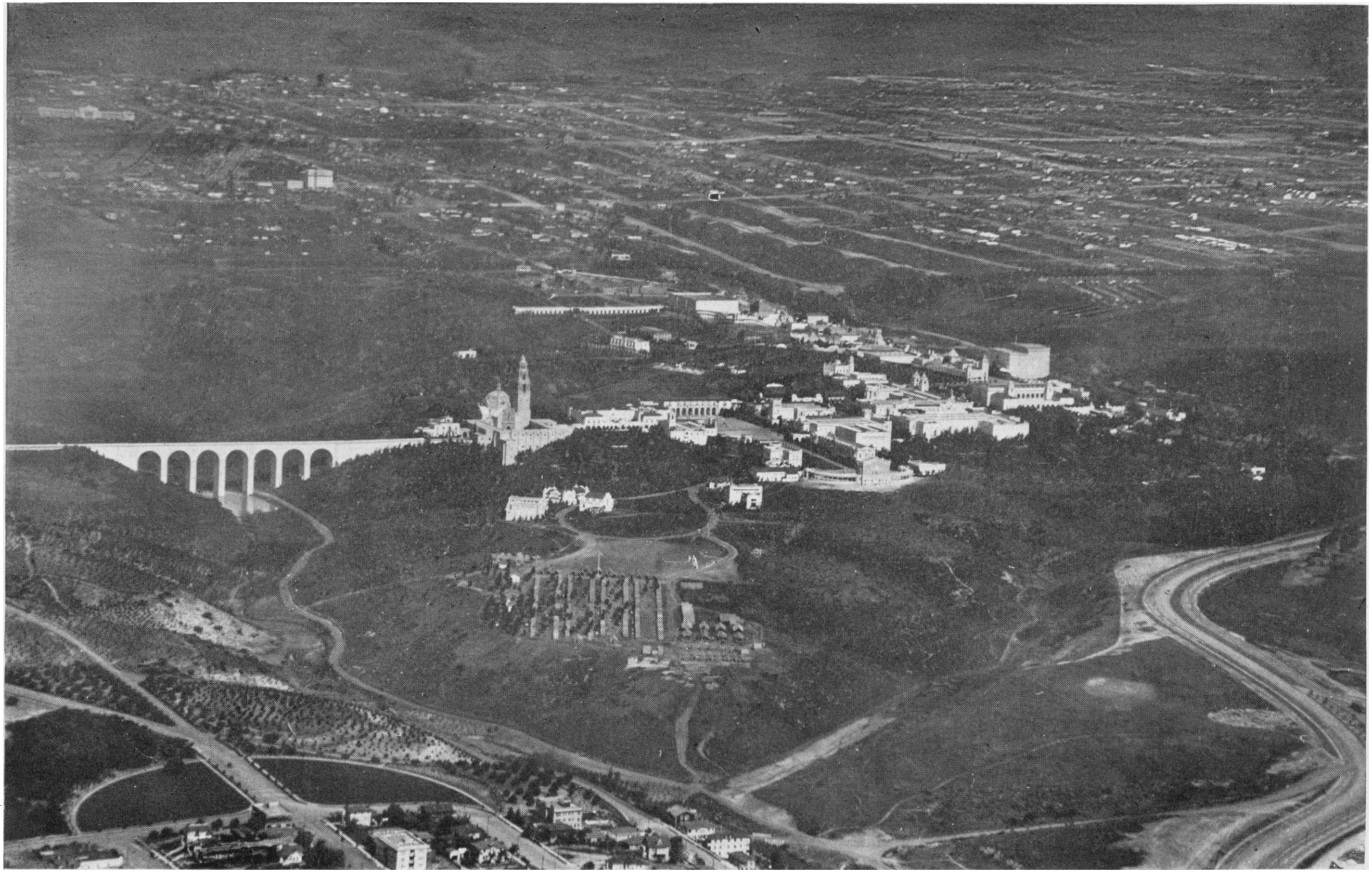

FIG. 6—The San Diego, Cal., Exposition of 1915-16, photographed from a flying boat. (Photo copyright by Harold A. Taylor, Coronado.)

done in Europe. In Europe there are over 7,000 licensed aviators, and not less than 100,000 flights with passengers are made each month. In America there are only about 300 licensed aviators, and only a few hundred passengers are carried in flight each month. The distance record across country without stopping is 750 miles in Europe and only 220 miles in America; the duration record is 18 hours 10 minutes in Europe and only 6 hours 10 minutes in America. Lack of inducement alone accounts for our backwardness.

AËRO CLUBS AS PROMOTERS OF THE EXISTING AËRONAUTICAL MAPS

Existing aëronautical maps are mainly the result of the work of the aëro clubs of France, Italy, and the United States. The same pioneer sportsmen and volunteers who were responsible for developing aëronautics in the different countries up to the time of the war were also responsible for the first aëronautical maps. The writer well remembers how these pioneers, who are now considered as pioneers and authorities in aëronautics and are given credit for having had ''wonderful foresight'' at that time, in the years from 1910 to 1914 were considered visionaries. Few people were willing to admit that aircraft within fifty or a hundred years would develop to such a point that aëronautical maps would be needed for their navigation. But these pioneers went on with their work.

In 1910 officials of the Automobile Club of America and the Aero Club of America combined efforts in making a topographical map of western Long Island for aëronautical purposes. This map gave the main routes, inhabited places, and landing fields suitable for landing aëroplanes. It was very creditable work for a time when a cross-country aëroplane flight of 25 or 50 miles was still considered an extraordinary event.

The aëronautical map published by the Aéro-Club de France has already been mentioned. The sheets already issued are used extensively by the French and British Flying Corps. M. Charles Lallemand, the well-known French scientist, is the chairman of the Aëronautic Maps Committee of the Aéro-Club de France.

In Italy the work of making the aëronautical maps has been shared by the aëronautical authorities, the authorities of the Touring Club of Italy, and the members of the National Commission of Aërial Touring. The Italian pioneers in aëronautical topography include Senator G. Celoria, the chairman of the National Commission on Aërial Touring; Commander Giovanni Roncagli of the Royal Italian Navy; Signor C. Usuelli, and other well-known Italian scientists. The pioneer work of these organizations was of great value to the military authorities of their respective countries in the present war. In France and Italy the aëro clubs were practically the only sources where the necessary information about aëronautical maps could be found, as little attention had been paid to this subject by the military authorities.

AN INTERNATIONAL COMMISSION TO FOSTER THE MAKING OF A WORLD AËRONAUTICAL MAP

Fostering the plans to make a world aëronautical map will be one of the purposes of the International Commission on Civil Aëronautics which is being organized under the auspices of the Aero Club of America, the Aërial League of America, and the Pan-American Aëronautic Federation. The membership of this Commission will include representatives of official bodies and national and international organizations interested in aëronautics of all the Allied and Pan-American countries. Officers of two of these organizations have already gone to France and while in Europe will collect data and study the plans of the Allied countries regarding aërial transportation and aëronautical maps and will arrange for the co-operation with the International Commission of aëronautical bodies and of official and scientific bodies interested in aëronautics.

RECENT COMMISSIONS ON CIVIL AËRONAUTICS

On January 6, 1917, a French Commission of Civil Aëronautics was created by ministerial decree to study the possibilities of using aircraft for the transportation of mail and for other commercial purposes. The first meeting of this commission was held on January 30, 1917, at the Bureau of Commerce, Industries, Agriculture, Labor, and Post Offices and Telegraphs.

The membership of the Commission includes representatives of the Chamber of Deputies, the Bureau of Post Offices and Telegraphs, the Aéro-Club de France, the Chambre Syndicale des Industries Aéronautiques, and the Aërial League of France. The meeting was opened with the statement that French genius had developed aëronautics to serve the cause of civilization, but that Germany had forced France to convert aircraft into instruments of war, and that it was not too soon now to look forward to the time when, after having defeated Germany, aircraft could be used extensively as instruments of peace for transportation and for developing closer international relations. Those present were urged to look into the future and see how far the employment of aircraft could be extended. This commission is now studying the subject.

On May 23, there was announced in the British House of Commons the creation of the Civil Aërial Transport Committee, to study the possibilities of the application of aircraft to commercial purposes. This committee includes representatives of the British Air Board, the Royal Aero Club, the Government of India, the Royal Flying Corps, the Royal Naval Air Service, the Colonial Office, the Foreign Office, the Post Office, the Treasury and Board of Customs, and the Meteorological Office. Its purpose, as stated in the House of Commons by Major Bair, secretary of the British Air Board and deputy chairman of the committee, is as follows:

> To consider and report to the Air Board with regard to: (1) the steps which should

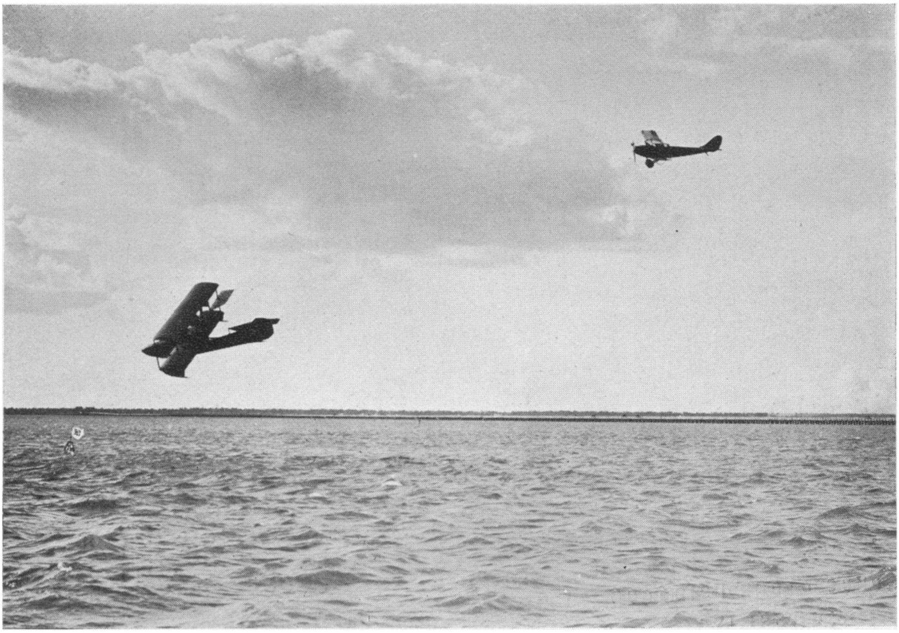

FIG. 7.

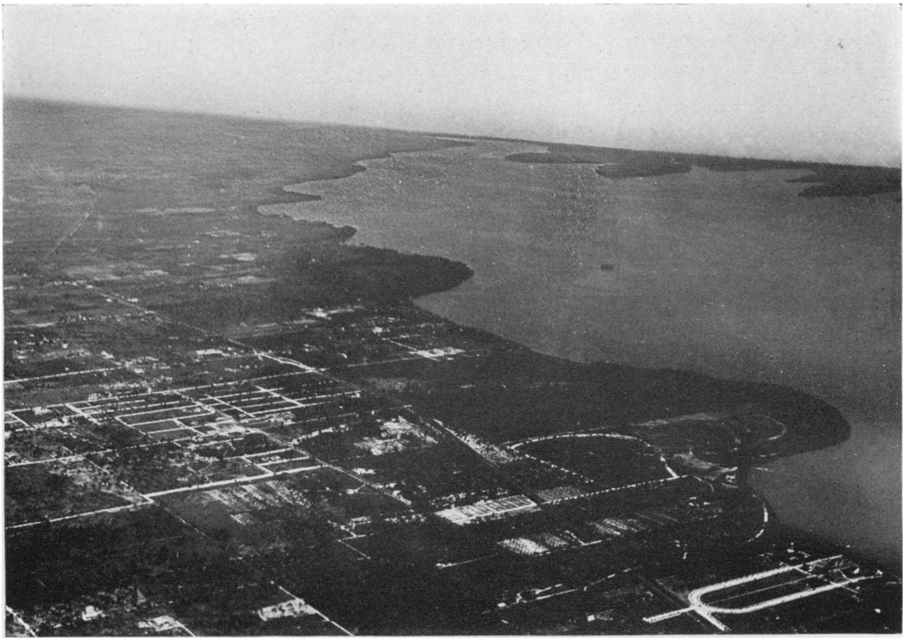

FIG. 8.

FIG. 7—A Curtiss biplane and a Curtiss flying boat flying along the Florida coast. (Photo by Goodrich, Miami, Fla.).

FIG. 8—Northern end of Miami, Florida, from an aëroplane, looking across the head of Biscayne Bay to the ocean beyond. (Photo by R. B. Hoit.)

be taken with a view to the development and regulation, after the war, of aviation for civil and commercial purposes, from a domestic and Imperial and an international standpoint. (2) The extent to which it will be possible to utilize for the above purposes the trained personnel and the aircraft that the conclusion of peace may leave over and above the requirements of the naval and military air services of the United Kingdom and the overseas dominions.

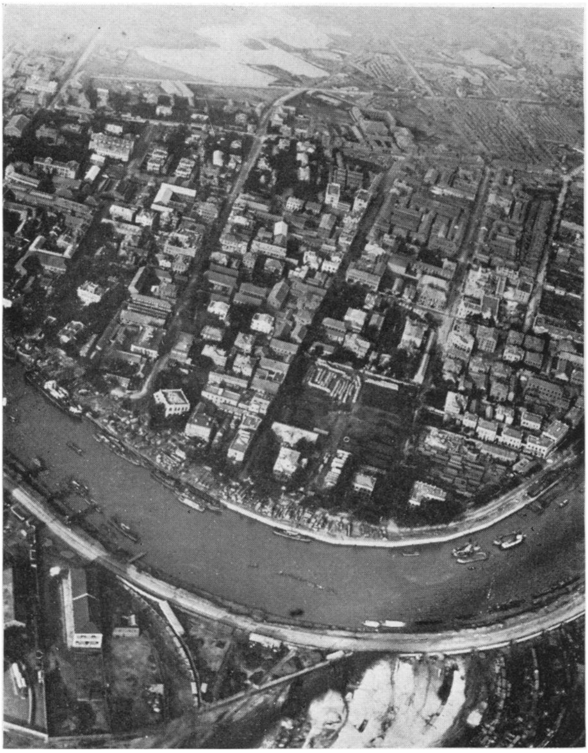

FIG. 9—The French Settlement at Tientsin, China, from an aëroplane. (Photo by René Caudron.)

The proceedings of the committee, to a large extent, will have to be confidential. The committee, I would remind the honorable members, corresponds to a similar body which has been already created in France under the presidency of M. d'Aubigny. It was set up by the Ministry of Commerce and was appointed to consider the routes to be followed in France, the Colonies, and in Allied countries, types of machines to be employed, types of postal car or carrier, bases, relay stations, and the recruitment of the personnel as well as the question of the purchase of hangars, aëroplanes, motors, etc., for the military authorities.

Lord Montagu's World Air Routes and Their Regulation

Colonel Lord Montagu of Beaulieu, Advising Mechanical Inspector to the Government of India, who has been one of the strongest supporters of the movement to develop the British aërial forces, on June 21, 1917, gave in a lecture at Central Hall, Westminster, on the world's air routes and their regulations, a very interesting forecast of the future of the aëroplane in relation to international commerce.

He pointed out that there is a chain of British aëronautical landing places southward and eastward from Gibraltar about 900 miles from London as the plane flies towards the Cape to Egypt, India, and Australasia.

Lord Montagu brought out many interesting points, including the following:

(1) As soon as the war is over there must be national and international laws for the regulation of flying.

(2) Oversea and over-continent routes must be defined in the interests of the whole world.

(3) The winds of the world, instead of being a drawback to flying over the surface of the planet, will, if properly used, prove to be of great assistance.

Dealing with the separation of traffic in "levels," Lord Montagu said:

> Now we come to the point at which we must inquire how flying round the world is to be regulated; how the principal lines of traffic are to be defined; the methods of constructing the principal aërodromes, which I will call "dromes" for short; the landing places for safety purposes. In considering these problems, it must be remembered that we have the third dimension to help us, that is, height and depth as well as length and breadth. Air traffic will present features similar to those on both land and sea in addition to marked new possibilities peculiar to the air.

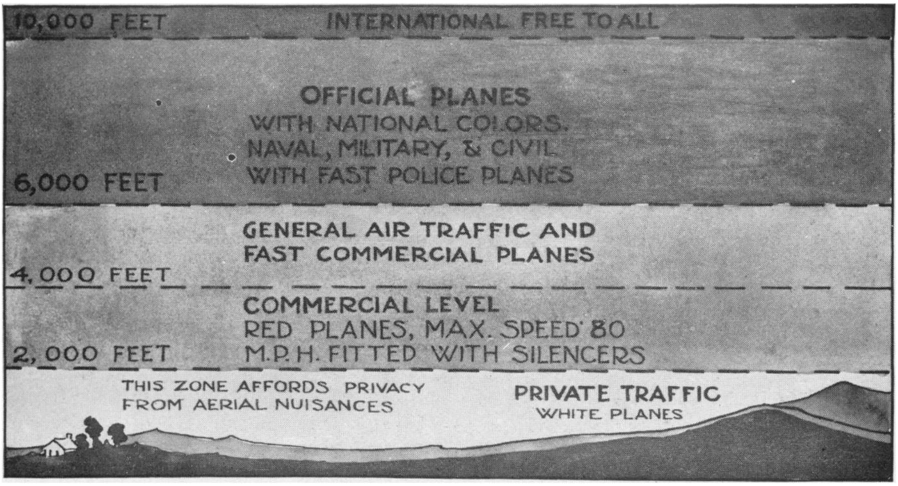

FIG. 10—Sketch showing Lord Montagu's conception of the conditions to govern aërial traffic in the near future, involving the establishment of various levels in the air. (Based on a copyright drawing in the *London Graphic* of July 7, 1917.)

> The general principle which I think should underlie all regulation of air traffic is that slow-speed planes should use the lower levels and high-speed planes the upper levels of the air. I suggest five levels, stretching from the earth's surface up to 10,000 feet, through which the various kinds of traffic should be classified to pass. The first 2,000 feet from the surface of the ground upwards should be prohibited to air traffic in general, but be usable, of course, by the private owner of the soil if he desires, and for the purposes of descending to his own landing or to "dromes" or intermediate safety landing places. This must be so, for aëroplanes will probably form one of our commonest means of locomotion in a few years' time, and provision must be made for all traffic to land at intervals of, say, 10 or 15 miles on defined routes.

> In admitting the claims that any air should be private, I conform, to some extent, to the present law of *usque ad coelum*, but I propose to limit that right to an altitude of 2,000 feet. Owners of houses and land, and the dwellers upon and in them, have a moral and probably a valid legal claim to be secured some privacy from nuisances arising from air traffic. Apart from noise, there may be the danger of voluntary or invol-

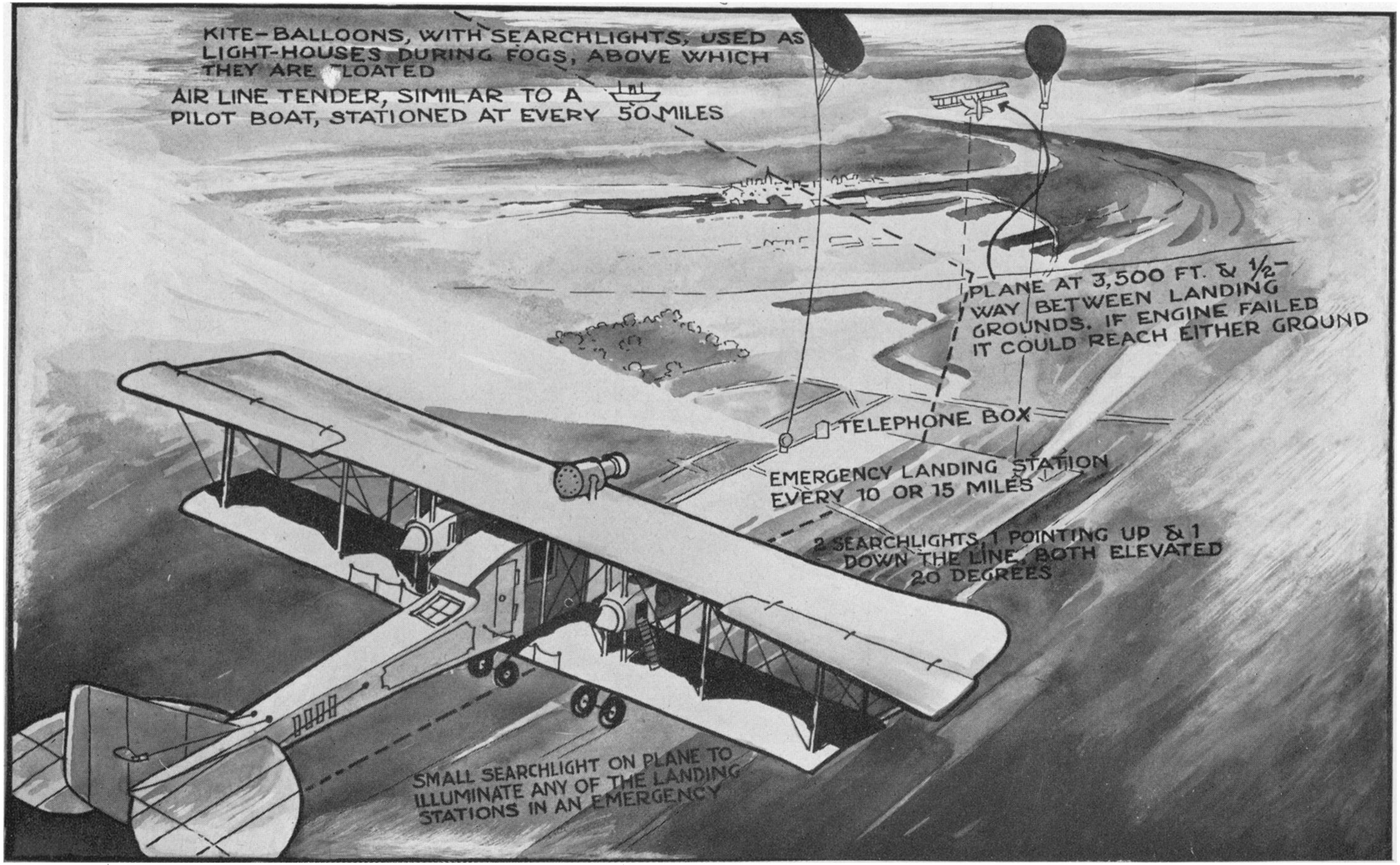
KITE-BALLOONS, WITH SEARCHLIGHTS, USED AS LIGHT-HOUSES DURING FOGS, ABOVE WHICH THEY ARE FLOATED
AIR LINE TENDER, SIMILAR TO A PILOT BOAT, STATIONED AT EVERY 50 MILES
PLANE AT 3,500 FT. & ½-WAY BETWEEN LANDING GROUNDS. IF ENGINE FAILED IT COULD REACH EITHER GROUND
TELEPHONE BOX
EMERGENCY LANDING STATION EVERY 10 OR 15 MILES
2 SEARCHLIGHTS, 1 POINTING UP & 1 DOWN THE LINE, BOTH ELEVATED 20 DEGREES
SMALL SEARCHLIGHT ON PLANE TO ILLUMINATE ANY OF THE LANDING STATIONS IN AN EMERGENCY

FIG. 11—Pictorial summary of proposed traffic provisions along a commercial air route, according to Lord Montagu. (Based on a copyright drawing in the *London Graphic* of July 7, 1917.)

untary descents. When flying becomes general everywhere, without some such regulation no privacy will exist for anyone except in lonely lands or dense forests.

Above this private level we come to the commercial levels, which I propose shall range from 2,000 feet to 4,000 feet. I place this class of traffic on the lowest of the flying levels, on account of the fact that commerce will want to operate as cheaply as possible, and to achieve height and speed means extra expenditure of motor spirit, whichever way it is looked at. And I would make this 2,000 to 4,000 feet level usable by silenced planes only with a maximum speed of 80 miles an hour.

Above these commercial levels I propose another zone of 2,000 feet, 4,000 feet to 6,000 feet for planes, also silenced, capable of speeds between 80 and 120 miles per hour. This will include the general air traffic of the planet for ordinary flying, including a proportion of fast commercial flying. As all aëroplanes will shortly be fitted with superchargers, or their engines designed and built for high altitudes, high flying will become quite easy. At present the decreasing density of the air at high altitude, leading to falling off in engine power, is a disadvantage. This will shortly be neutralized so that the engine produces the same or even greater power at a height than at the earth's surface. This is, of course, a height where human health and comfort will be affected owing to the effects on the blood of decreased atmospheric pressure, such as what is called "fizzing," and the chance of faintness and heart attacks when a rapid descent takes place. The intense cold also at high altitudes will tend to keep passenger traffic, as a rule, in the lower levels, for there is a decrease of about 5° Fahrenheit for every 1,000 feet of height.

Above 6,000 feet to 10,000 feet I would reserve the levels for the official planes of each nation. These levels would be used by its naval, military, and civil forces, and by police planes, for air police will be needed in the same way that policing of routes by land and sea is now necessary. Specially authorized pilots, and perhaps postal services, will also use the 6,000 to the 10,000 feet levels, where the international levels will begin. I would remark here that unless we are to have lawlessness and anarchy in the regions of the air there must be efficient control—this is an axiom of efficiency and civilization. Control of the levels can only be exercised, nationally and internationally, by police pilots on fast planes above ordinary traffic, where, with the forces of gravity to aid, they can descend with a superior swiftness upon malefactors and breakers of the law of the air, take their numbers, or compel them to alight at the nearest landing place or drome. There must also be no unsilenced machines regularly operating below 8,000 feet—I am not sure whether that limit is high enough—for even above that height the noise of many open exhausts and the hum of many propellers may become a continuous and nerve-racking nuisance. A serious amount of unpopularity and agitation against the use of unsilenced planes will have to be faced before long.

Now we come to the levels above 10,000 feet, which I propose should be internationalized. The upper air should, I think, be free to all, under certain regulations, provided pilots comply with certain rules for meeting and overtaking and their craft passed as air-worthy—let us say, registered as A1 in a Lloyd's aërial register. This would follow the precedent, which has worked well, of the three-mile limit at sea open to all ships of all nations. Great altitudes will impose upon ordinary flying some disadvantages which will tend to keep international flying over land and over sea near the 10,000-feet limit, and flying at these levels will probably, so far as international flying is concerned, be conducted along routes to be defined by methods to which I will allude presently, and in some cases nations may agree to admit international traffic to its own levels. But if a particularly cantankerous nation objects to admit any traffic to the lower levels below 10,000 feet, the air routes will not be altogether barred. It is clear, also that there will be prohibited areas, naval and military centers, and flying over thickly populated districts will probably be avoided on account of a certain risk to those who are still content to crawl about on the earth. But, of course, this will not preclude, as I

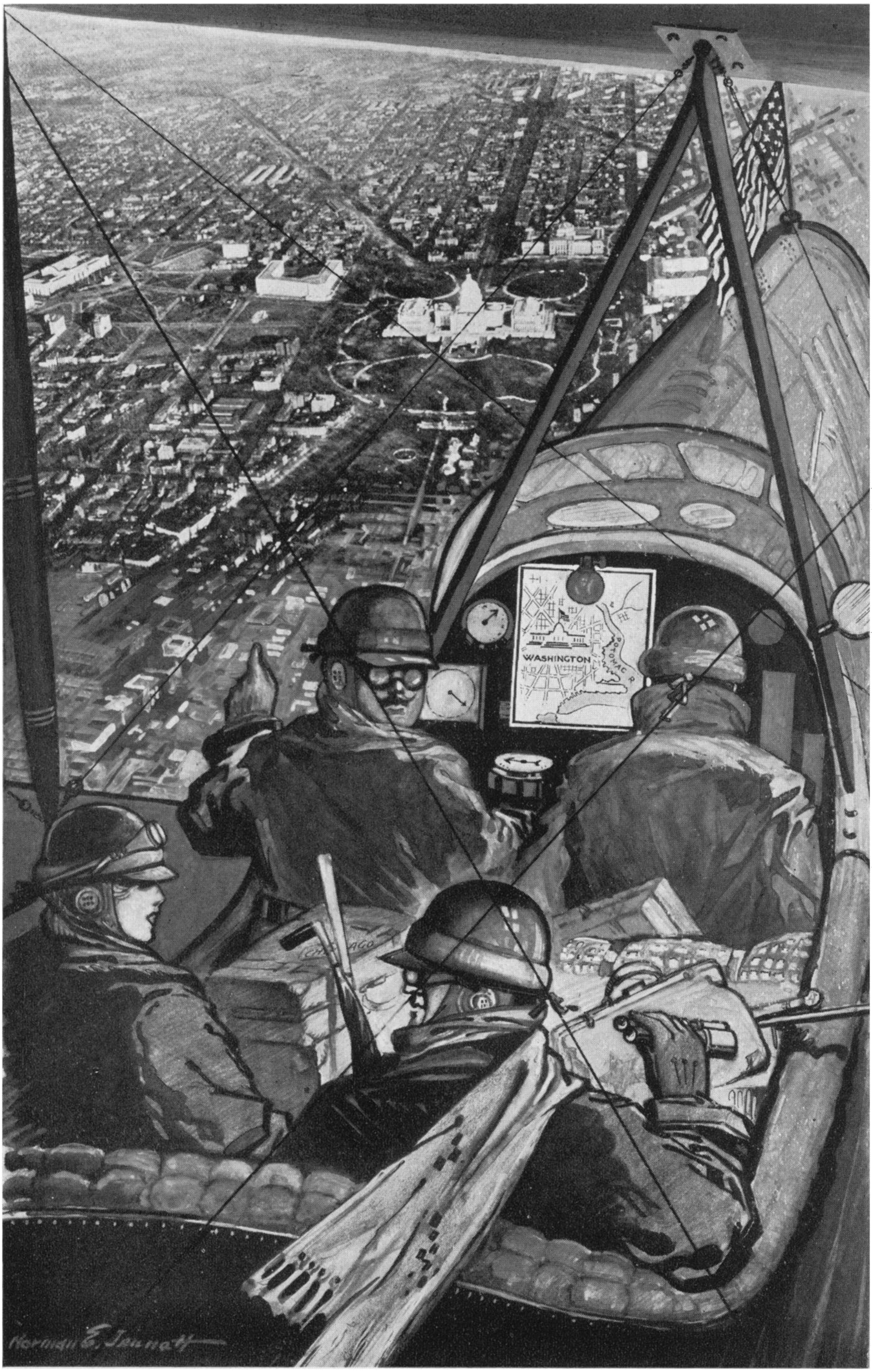

FIG. 12—Sketch showing the use of a map on an air journey. The aëroplane is represented as approaching Washington, D. C. The map, printed on a long strip, is mounted in a holder which passes over two rollers, which can be turned so as to bring before the aviator the locality above which he is flying. (Drawing by N. E. Jennett.)

have said, the air liners of different countries using the lower levels when necessary under license from the countries over which they pass. Then, postal and passenger services may sometimes be driven down to lower levels owing to stress of weather.

Aircraft desiring to leave their own levels will, of course, use their wireless to ask permission from national or international flying authorities. But in this case they should conform, at least so I think, to the rules for silence and any other restrictions which may be found necessary in the lower levels to ensure the peaceful enjoyment of the earth's surface by its inhabitants. The problem of how to secure law and order on oversea routes is more difficult, and for this purpose it seems to me that we shall eventually have to define the paths to be followed within, say, certain degrees of latitude and longitude. It is here again that international control will be necessary, and this control must be backed by international force in the shape of air police, for without force behind them conventions and international arrangements are as futile as the resolutions of the Hague Convention have proved to be. It may be, therefore, that flying over the sea outside the three-mile limit will become a question of routes outward and homeward with no exactly defined air levels or a fewer number of levels, for there are no inhabitants to annoy over the wide spaces of the ocean, and no one to kill or annoy, barring the very remote risk to those few human beings who will still be navigating the sea in ships, probably submersibles by then.

COLONEL O'GORMAN'S PLANS FOR EMPLOYMENT OF AIRCRAFT IN TRANSPORTATION

Lieutenant Colonel Mervin O'Gorman, C.V., late Superintendent of the Royal Aircraft Factory, delivered a very able paper at the Grafton Galleries, London, on June 13, 1917, in which he outlined the possible use of aircraft for commercial purposes. Only a synopsis of his paper can here be given.

Colonel O'Gorman divided commercial aëronautics into three parts, as follows: (1) the home, or internal aspect; (2) the foreign, or international aspect; (3) the Imperial and Colonial aspect. He outlined the possible use of aircraft for transportation and some of the questions to be considered in connection with internal British aëronautics as follows:

(1) The uses of aircraft.
    (a) Transit of goods.
    (b) Transit of letters.
    (c) Transit of persons.
    (d) Labor of transit service.
    (e) Finance of transaërial companies.
    (f) Government subvention of aërial transport.
    (g) Private, sporting, and domestic use.
    (h) Scientific use, surveys, etc.
(2) The safety provision.
    (a) Aërial routes and lines of landing grounds; maps.
    (b) Night flying and landing.
    (c) Aërology and meteorology.
    (d) Wireless communication of distress, orders, and signals of directions.
    (e) Labor of ground upkeep, etc.
    (f) Subvention of safety precautions and grounds.
    (g) Accidents, investigation.
    (h) Keeping of records.
    (i) Insurance of (1) pilots; (2) passengers; (3) craft.

(3) Education of personnel.
    (a) Designers and engineers.
    (b) Fliers and navigators.
    (c) Military call on fliers.
    (d) Polytechnic and correspondence schools for labor.
    (e) Subvention of education.
    (f) Collation of data, research.
    (g) Inventions.
    (h) Consular trade information, etc.
(4) Production of aircraft.
    (a) Best employment of existing factory organization.
    (b) Finance and subsidies to makers.
    (c) Military and naval requirements.
    (d) Publicity and "load curve orders."
    (e) Utilization of overplus of military and naval war orders.
    (f) Supply of aircraft to foreign governments and colonies.
(5) Labor (general question).
    (a) Skilled and unskilled.
    (b) Male and female, including military, wounded, pensioned, etc.

The problems to be considered in connection with foreign aëronautics were defined by Colonel O'Gorman as follows:

(1) Post-war intergovernmental agreements (allied and enemy).
    (a) Flying rights.
    (b) Landing rights.
    (c) "Rule of the road."
    (d) Supply of aircraft to foreign governments.
    (e) International law, prohibited areas, etc.
(2) Registration of craft.
    (a) Salvage by ships and by aircraft.
    (b) Exchange of meteorological news.
(3) Post office reciprocity.
    (a) Prices for postage.
    (b) Methods of collection and delivery.
    (c) Agreed routes.
(4) Customs and policing.
    (a) Quarantine and aliens question.
(5) The formation of industrial links, co-ordinating technical societies.

HOLT THOMAS' "COMMERCIAL AËRONAUTICS"

The economic side of commercial aëronautics was discussed in a paper read before the Aëronautic Society of Great Britain on May 30, 1917, by Mr. G. Holt Thomas, one of the pioneer British aëronautical authorities. His paper discussed the cost of establishing and operating air lines between such points as London and Paris, London and Marseilles, and London and Constantinople. It also outlined possible air lines across the Atlantic and from London to Ceylon, London to Tokio, London to Sydney, and London to Vancouver. Like Lord Montagu and Colonel O'Gorman, Mr. Holt Thomas expressed his belief that transatlantic air lines will be established in the near future.

POSSIBILITY OF ESTABLISHING TRANSATLANTIC AIR LINES

Speaking of the possibility of crossing the Atlantic, Lord Montagu pointed out

> that winds of from 40 to 50 miles per hour are not uncommon in the upper air in the temperate zone, while 30-mile winds are frequent; therefore in the case of flying even a favorable 30-mile wind would add 720 miles to the day's run, while a head wind of a like speed would take 720 miles off the distance covered. In other words, there would be a difference of 1,440 miles in every twenty-four hours between a 30-mile wind favorable to the course of the aëroplane and a 30-mile wind against it—a difference so great as to make longer mileage a matter of comparative indifference. To show what this may mean I have only to state that it is about 1,800 miles from a point in County Kerry in Ireland to St. John's, Newfoundland. Assuming that an aëroplane started from St. John's with a 30-mile westerly wind behind it, and was capable itself of a speed of 80 miles per hour, the combined speed of 110 miles an hour over the surface of the globe would mean that in about sixteen and a half hours after leaving St. John's the seaplane or aëroplane could alight on the coast of Ireland. With a contrary wind of 30 miles per hour the speed of the seaplane would be reduced to 50 miles per hour over the earth's surface, and the journey would take thirty-six hours instead of sixteen and a half, or nearly twenty hours longer.
>
> Already there exist machines which, by substituting a load of petrol for a load of bombs, could remain in the air over sixteen hours, so I am not putting forward an impossible example.
>
> It may be advisable, therefore, in some states of the atmosphere to fly to the North American continent via Iceland and Greenland; in other states of the atmosphere via France, Spain, Portugal and the Azores. The reasons for these circuitous routes will be seen in some diagrams which I shall show you. It is clear, therefore, that meteorology and the study of wind currents is going to be of supreme importance. The knowledge of the world's atmospheric conditions and accurate forecasts, apart from their inherent scientific interest, may affect the saving or spending of millions of money annually when postal and commercial aviation is established.

ITALY'S PRE-EMINENCE IN ESTABLISHING AIR LINES

Italy is far ahead of other nations in establishing air lines. It has had a number of air lines in actual operation for nearly a year, and Lieutenant Colonel O'Gorman and Mr. G. Holt Thomas have expressed their indebtedness to Major Perfetti, head of the special Italian Military Commission for Aëronautics in the United States, for the valuable data which he supplied them on the general subject of aërial transportation and the problems connected with international transportation.

Major Perfetti, who has accepted an invitation to become a member of the International Commission on Civil Aëronautics referred to previously, recently delivered an address in New York under the auspices of the Aero Club of America and the Automobile Club of America in which he made known the fact that Italy has been using for some time, and most successfully, huge warplanes, capable of lifting 2,750 pounds of bombs, besides the equipment in fuel needed for a flight of eight hours at a speed of 80 miles an hour. The latest Caproni triplanes are equipped with three motors of 600 horse-power each and will carry five tons of explosives and fuel for twelve hours at a speed of about 80 miles an hour. Plans for a larger machine of this type, capable of carrying 50 passengers and of crossing the Atlantic with a sufficient load to make transatlantic transportation a commercial proposition, are being completed.

The German Plans for Aërial Transportation

In a recent number of the *Tägliche Rundschau* the German plans for aërial transportation were outlined. A company has been formed under the name of "Central European International Aërial Traffic Company." The plans provide for three main air routes, as follows: (1) Hamburg, Berlin, Vienna, Budapest, Constantinople; (2) Strassburg, Stuttgart, Munich, Vienna, Budapest, Constantinople; (3) Berlin, Dresden, Prague, Vienna, Constantinople.

Aëronautical Maps of the Future

Now that aëroplanes have grown to such tremendous size and that the leading nations are planning to use aircraft extensively for transportation, an aëronautical map of the world will become a necessity. Besides a general map of this type it will be necessary to have more detailed maps of the permanent aërial routes; and in view of the changes in the aspect of the earth due to the seasons and the change from day to night, it may be well to have different editions for summer and winter flying and for daytime and night flying.

Night flying implies that the maps will have to show the location of the special lighthouses that will be set up for air travelers as well as photographic reproductions of cities as they look at night when lighted up. The lighthouses, of course, will be the landmarks for the pilots traveling at night. Maps for winter flying will need to place emphasis on special landmarks which will have to be established and which, by contrast, will permit the air pilot to recognize the place, notwithstanding the snow.

If the plan of having different types of air traffic at different levels is adopted, then it may also become necessary to have suitable maps for the different levels, according as the speed is limited or unlimited. Aëroplanes going at 80 miles an hour and flying at a height of only 3,000 feet must have many more landing places than machines flying at tremendous speeds at over 10,000 feet. These, being engaged in international air traffic, are like express trains flying between important centers and therefore do not need detailed maps.

Now that aëroplanes are brought to the size which permits them to travel several thousand miles without stopping and now that dirigibles can navigate the air between 50 and 60 hours at a time, aërial navigation is an established fact. Furthermore, aërial navigation is the only navigation that is international in character, because no natural obstacle can prevent the progress of the aircraft as natural obstacles prevent the progress of ships and trains.